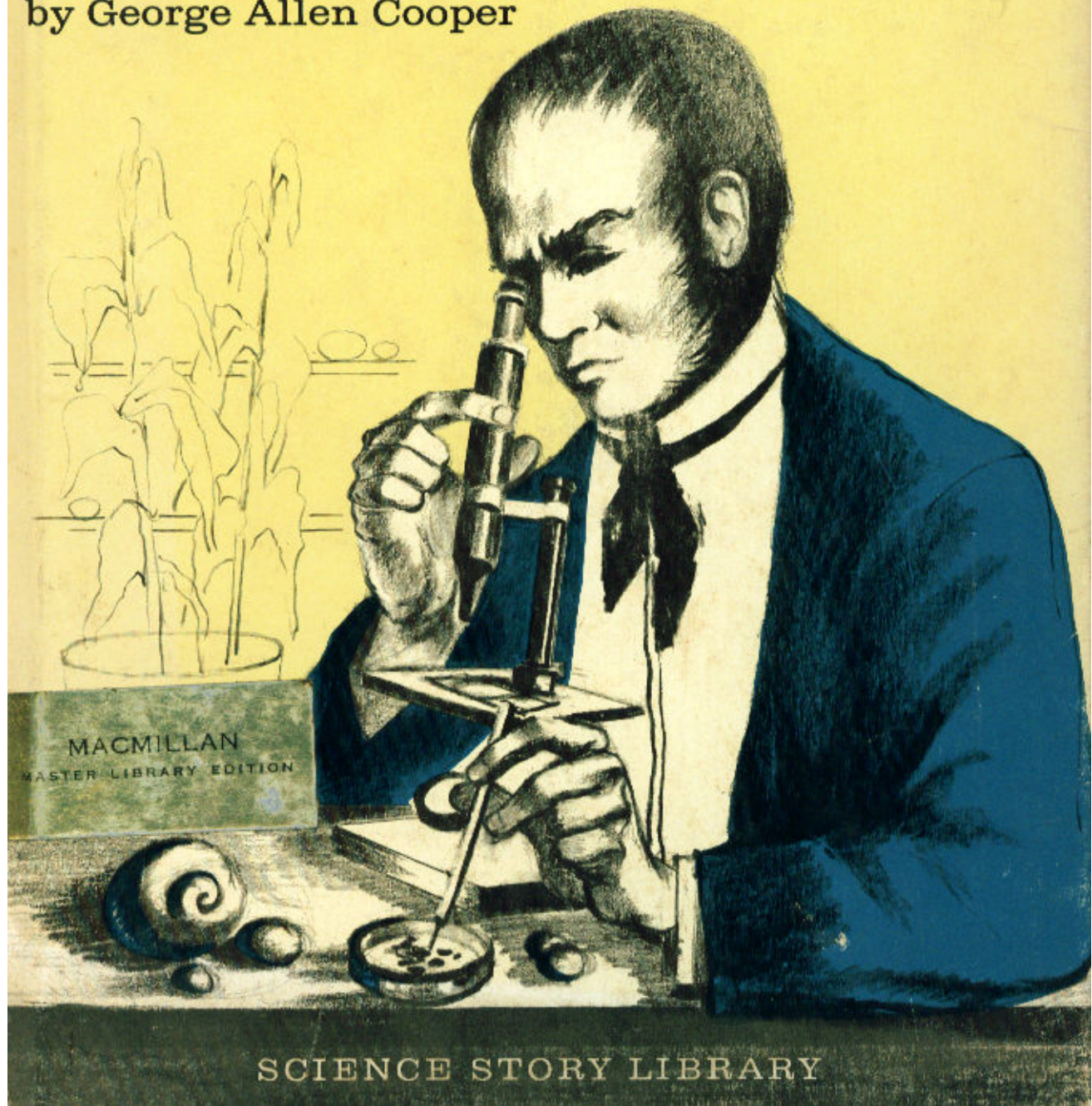


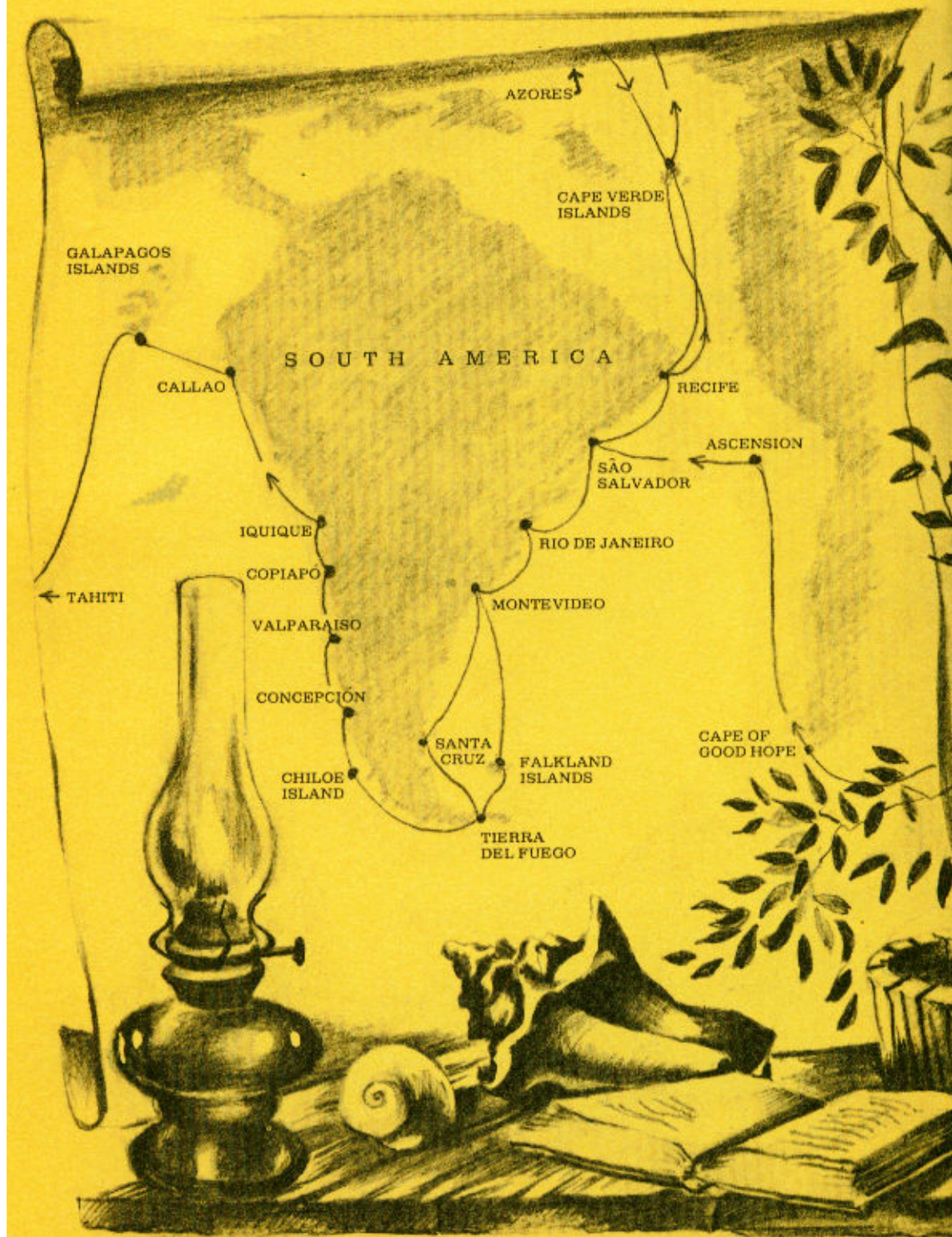
Charles Darwin

VOYAGER-NATURALIST

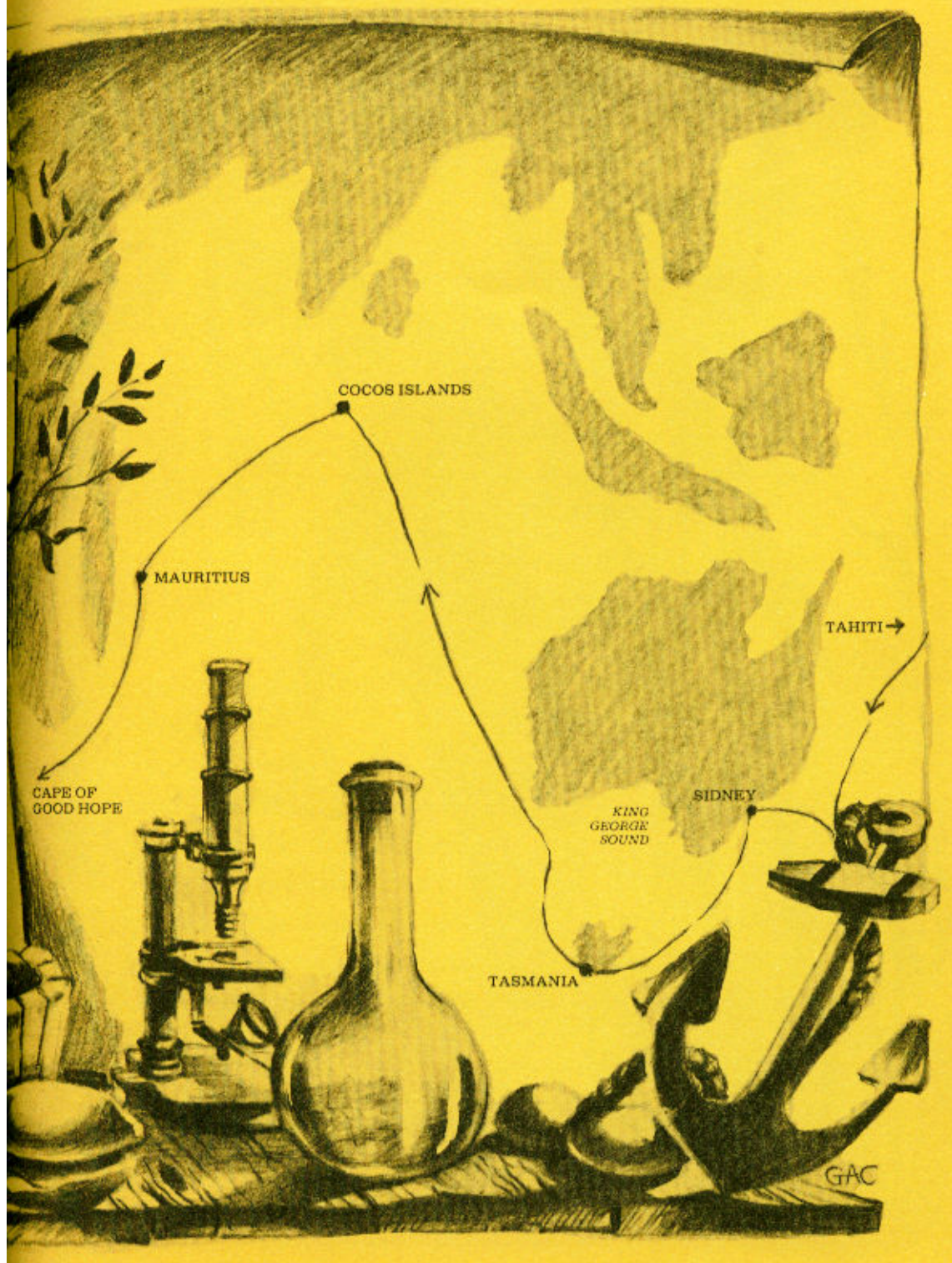
Written and illustrated
by George Allen Cooper

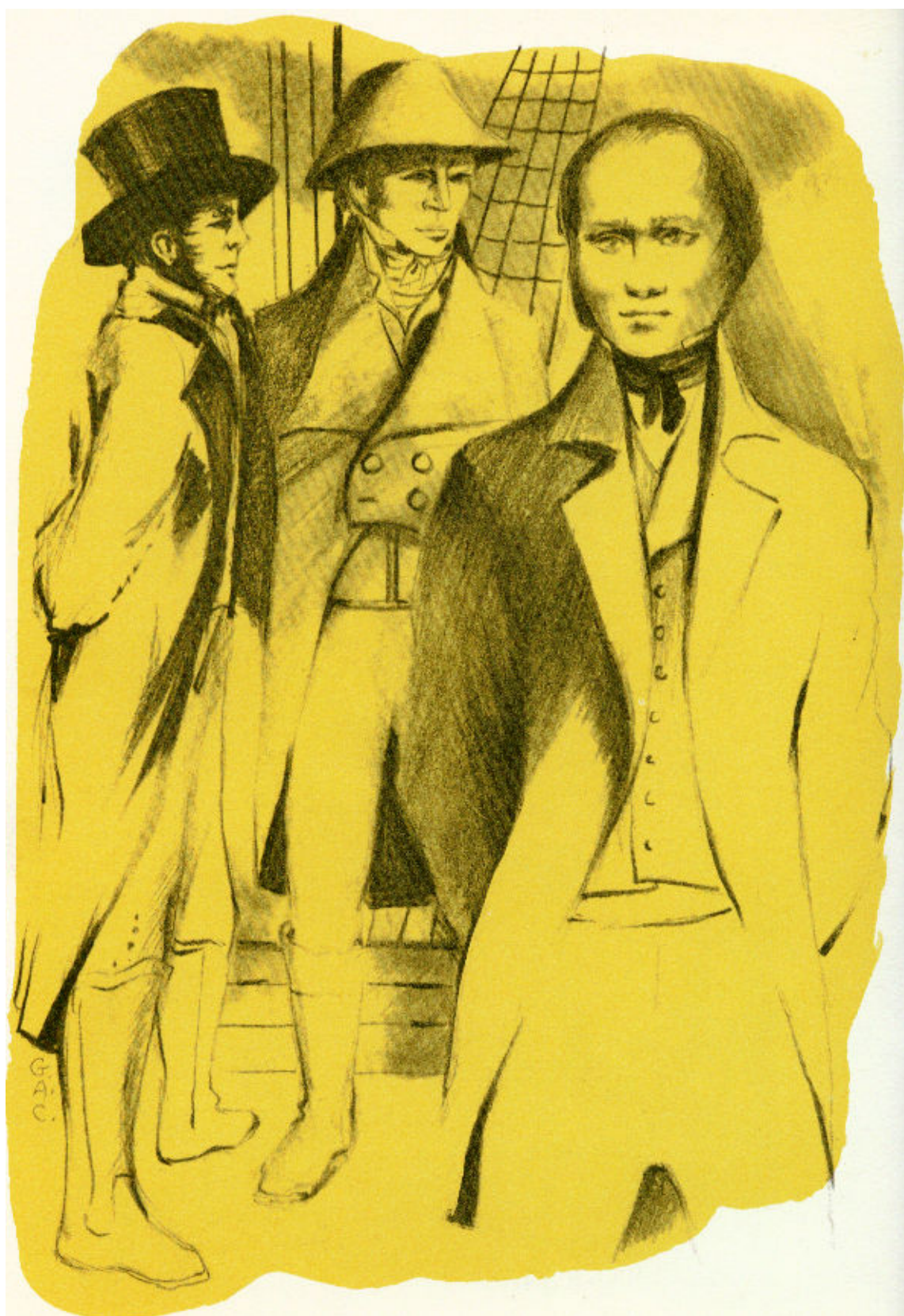


THE VOYAGE OF THE



BEAGLE 1831-1836





A young man, twenty-two years old, stood on the quarter-deck of the H.M.S. *Beagle*—a British warship in the harbor at Plymouth, England. It was the second day after Christmas, 1831. He had been in the seaport town for almost two months now, and his restlessness increased as he waited for the hour when the ship would finally sail.

The *Beagle's* task was to circumnavigate the globe to obtain more accurate measurements of the earth's longitude, or east-west distances. The ship was to sail south to Brazil to map the South American coast and then continue around the world. During the next five years it would be this young man's job to collect and study all the animal and plant specimens he could find wherever the ship landed.

It was a bleak winter afternoon. The young man watched the dark sky and the angry blue-gray clouds massed on the eastern horizon. The skies to the south-east, the direction in which the *Beagle* would sail,

seemed even more ominous. He worried: Would yet another storm keep the ship from her voyage? The *Beagle* had been scheduled to leave on November 4th, but the date had been changed because of high tides and unfavorable winds. Twice in December the ship had put out to sea only to be driven back to port by southeast gales and enormous waves.

The H.M.S. *Beagle* was a strong seaworthy vessel that had recently come back from a voyage to Tierra del Fuego at the southern tip of South America. In Plymouth she had been completely refitted with a mizzenmast, lightning rods, and new sails. There was new brass everywhere and her original deck wood had been replaced with strong mahogany.

Besides the young man, there were seventy-one people on board, including twelve officers, two surgeons, six cabin boys, two servants, thirty-four seamen, ten marines, and a purser. Also aboard were three natives of Tierra del Fuego and a missionary who was to accompany them back to their home.

By two o'clock the ship was ready for departure. The young man's relatives watched from the wharf as the officers and crew manned their stations. Finally the captain's orders were given, the anchor was weighed, and the dock lines were cast off. From the wharf came

cries of "Safe trip!" and "Godspeed!" The *Beagle's* white sails filled with a steady breeze as she moved out across the dark water.

The young man waved farewell to his family and friends, and to England. He did not suspect that his adventures and discoveries would someday change the whole history of science. His name was Charles Robert Darwin, and the voyage of the *Beagle* was to be one of the greatest voyages of all time.



Charles Darwin was born in the small English country town of Shrewsbury on February 12, 1809. His mother, Susannah, was the daughter of Josiah Wedgwood, whose pottery factory was famous throughout England. Charles' father, Dr. Robert Darwin, was one of the most successful and wealthy physicians practicing outside London.

Shrewsbury stands on a big rocky hill which overlooks the Severn River. Here, Stone Age hunters once roamed; here Englishmen had fought off the invading Romans. The walls of a castle built in the Middle Ages still stand, reminding people of the town's great age.

Charles was born in a house called "The Mount," which stands on a bank above the town's river. A large square structure of Georgian style, it was built by his father in 1800.

From his earliest days, Charles was a nature lover. By the time he was six he had amassed a collection of dozens of plants, nests, insects, and birds' eggs. He was never happier than when exploring the fields and woods surrounding The Mount. Almost every day he would return with a new specimen to show his family.

The first school Charles attended was Mr. Case's day school in Shrewsbury. From the first day Charles hated school. Although he hoped to learn everything



he could about nature, he did not care for the regular subjects—Greek and Latin. The woods and streams were the places he loved, not the classroom.

By the age of ten Charles had gained considerable knowledge of animals and plants. His powers of observation had sharpened. Not only could he identify hundreds of insects at sight, but he could tell the ones that were native to Shrewsbury from those that were not. And he could identify almost every kind of bird he saw.

Charles knew that he wanted to become some kind



of scientist but he was not sure just what he wanted to study. Perhaps he would become an ornithologist and devote his life to the study of birds, or he might become a botanist, or a chemist.

At home Charles' older brother Erasmus built a chemical laboratory in the garden toolhouse. Charles assisted Erasmus in performing experiments. The two brothers sometimes worked late into the night making different gases and compounds. Thus Charles continued to learn more and more science, although his schoolwork remained barely adequate.

Dr. Darwin had made up his mind that both Erasmus and Charles would become physicians, so in the fall of 1825, Charles was enrolled to study medicine in the University of Edinburgh. Dr. Darwin predicted that his younger son would become a very successful doctor.

The prediction proved wrong. Charles found the medical courses thoroughly boring and he could not endure the sight of people in pain in the operating rooms. Charles neglected his classes and continued his nature study. For him, the most exciting event in Edinburgh was the visit of the American artist-naturalist John James Audubon. Young Darwin sat spellbound as Audubon lectured on animal life in America. He decided then and there that his life would be of worth only if he could add to man's knowledge of natural history.

When his first year of school ended, Charles traveled

to Paris with his uncle Josiah Wedgwood to bring his cousins, Fanny and Emma, back to the Wedgwood home at Maer. He spent most of his vacation with the Wedgwoods, and by the end of the summer he knew that he was in love with Emma. Charles promised himself that someday he would marry her. With regret he returned to his university in the fall.

By the end of Charles' second year at Edinburgh, Dr. Darwin was forced to admit that a medical career was out of the question for his son. In 1828, at nineteen, Charles entered Christ's College, Cambridge, where he remained for three years.

Charles' years at Cambridge were happy ones, not because of the formal education he received there but because of the friendships he made and the scientific knowledge he acquired.

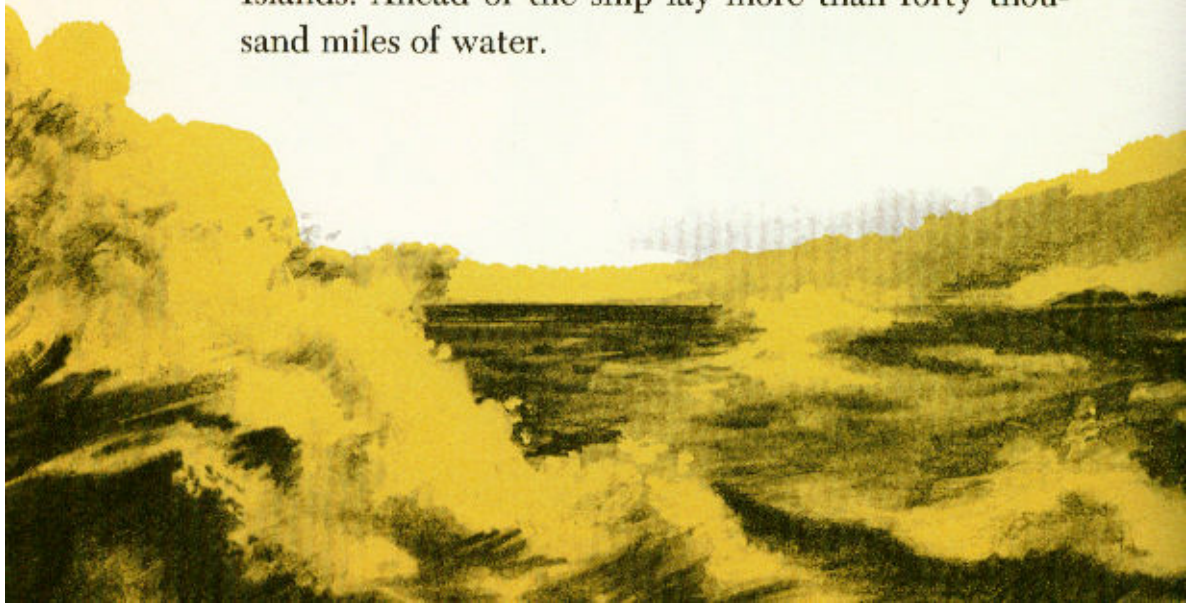
Charles became friendly with the Reverend John Stevens Henslow, a professor of botany. The two men would take long walks through the beautiful countryside around Cambridge. Henslow had a great fund of scientific knowledge and he recognized Darwin's talents as a naturalist. It was Professor Henslow who gave Charles the most important opportunity of his life.

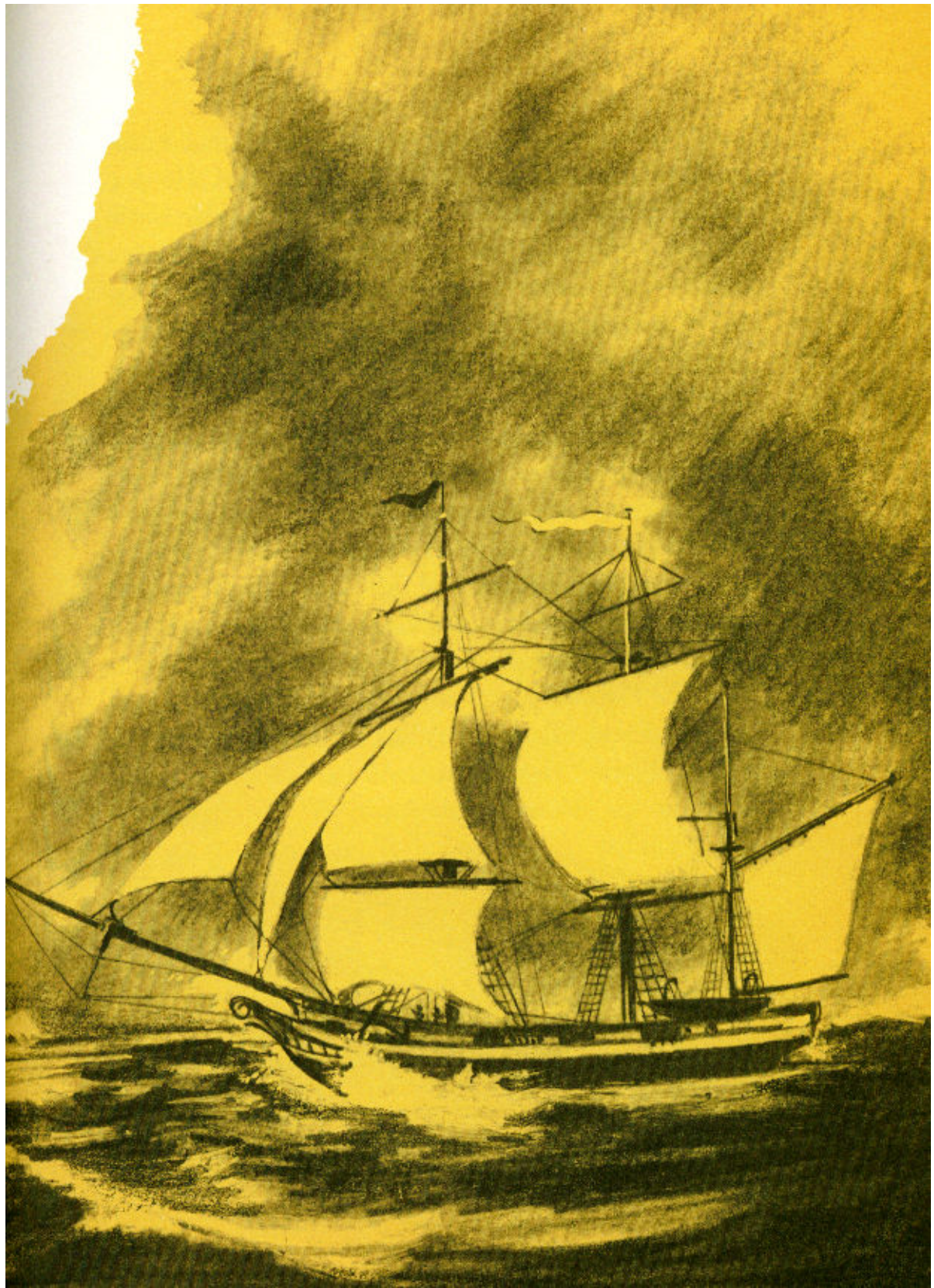
In April of 1831 Charles graduated—without honors. After a trip to Wales, he returned to Shrewsbury

to visit his family before going to see Emma at Maer. When he arrived at The Mount he found a letter from Professor Henslow. Captain Robert Fitzroy of the Royal Navy had been asked to select a young man to sail around the world as a naturalist aboard a warship, and Henslow's choice was Charles!

When Dr. Darwin heard of the proposal he refused to permit Charles to go. He believed that such a voyage would be dangerous and a waste of time. Charles had almost given up hope when his uncle Josiah came to his rescue with strong arguments for his going. After lengthy debate, Dr. Darwin gave his permission. So Charles Darwin acquired the title Naturalist in His Majesty's Service. He would sail before the year was out.

The H.M.S. *Beagle* rolled and plunged as the sea grew rougher. A keen eight-knot breeze from the north drove her on a steady course toward the Canary Islands. Ahead of the ship lay more than forty thousand miles of water.





Robert Fitzroy, the *Beagle's* captain, had borne much of the expense of outfitting the ship. He possessed a large private fortune and was of noble birth: one of his grandfathers was a Duke, the other a Marquis. Conservative in both religion and politics, Captain Fitzroy was a Fundamentalist, as men were called who thought every word of the Bible to be literally true. He believed that the universe had been created out of nothingness, just as the Bible said, and that all creatures had been formed in a single day.

Charles stayed in his cabin while the captain guided the *Beagle* on her southern course. At night, when he could not sleep, he watched the moon and the stars of the Southern Cross. By day he read a book which had been a last-minute present from Professor Henslow. It was *The Principles of Geology* by Charles Lyell. Henslow had said, "Do not pay any attention to it except



for facts, for it is altogether wild as far as theory goes.”

In the book Lyell presented the idea that the creation of the world was not completed in six days. He maintained that the oceans, the continents, and the great mountain chains had been formed by natural causes over millions, perhaps even billions of years.

In 1832 most geologists believed, as Captain Fitzroy did, that the earth and all things on it were the direct result of God’s creations and destructions. Lyell’s ideas were not only considered outrageous, they constituted religious heresy. As Charles read on, Lyell’s ideas, though radical, seemed possible. Perhaps the Bible was wrong. Perhaps the earth was not formed in a single day. Perhaps the earth was constantly changing. Perhaps changes were occurring even now. Could Lyell be right?

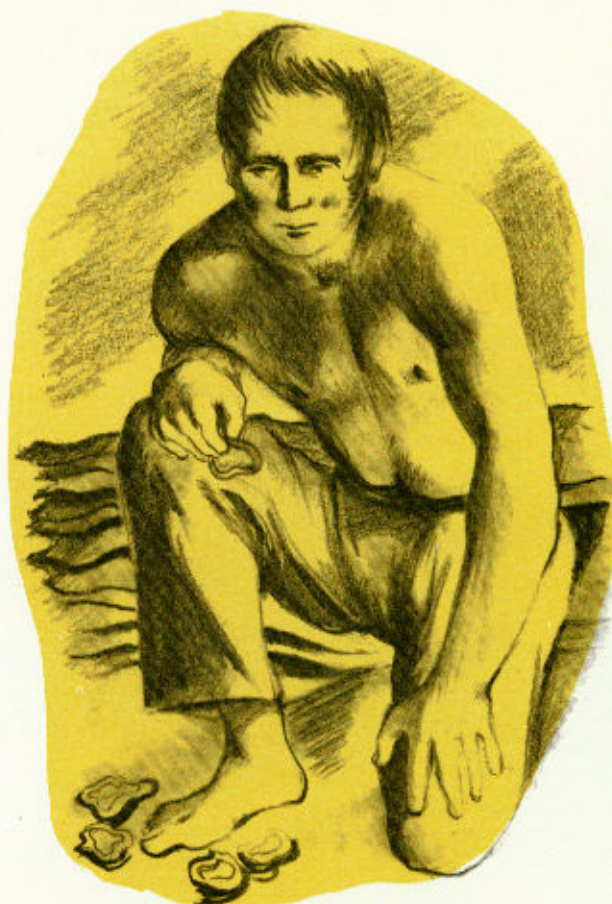
On January 6th, Charles awoke to see an island about which he had dreamed. It was Tenerife in the Canary Islands. He dressed and rushed up on deck, only to be disappointed. He was not to explore it, for the islanders had received word of a cholera epidemic in England, and British ships were not permitted to land. Charles heard his captain shout “Up jib!” and they moved away toward Cape Verde off the African coast.



Ten days later the *Beagle* anchored at Porto Praia on Santiago, one of the Cape Verde Islands, and Charles set foot on a tropical island for the first time. He was elated at the sight of vegetation so different from that of England. He walked through groves of coconut trees. He gorged himself on oranges and tasted his first banana. He amused himself by watching kingfishers catching not fish but grasshoppers and lizards. On the beaches Charles admired the beauty of the young black girls in their snow-white dresses and pink turbans.

Soon he discovered a strange-looking white band that ran horizontally across the face of a cliff high

above the water's edge. The band was composed of tiny shells embedded in rock; yet it was forty-five feet above the surface of the ocean. Charles took careful measurements of the band and noted everything he had observed in a small book together with a question: "Does this discovery show that the land here has risen, or has the level of the sea dropped?" He concluded that this find might be his first evidence in support of the "wild" Lyell theory.



On February 29, 1832, with the *Beagle* anchored offshore, Charles wandered alone through the vast rain forests of Bahia, Brazil. He was astonished at the height of the dark trees and the strange parasitical plants. The whole earth seemed to be alive with growth. Wildly colored birds were everywhere, and the air at high noon was filled with the whine of insects. But, curiously, the thing that impressed Charles the most was silence. At certain times just after the monkey chatter was loudest and the bird squawks and screams greatest, silence would suddenly fall, and Charles could hear only the crunch of dead branches beneath his boots.

At night when he returned to the *Beagle* he thought of what he had seen. Deep questions stirred in his mind. What incredible force had created such an enormous variety of living things? Were they all created in less than a week to stay unchanged through the rest of time, as Captain Fitzroy and the other Fundamentalists believed? Or was the creation of new living things taking place right now?

Month after month the *Beagle* plied her course up and down the east coast of South America. Charles spent every possible day in inland explorations while the coastal surveys and depth charts were being made.

His collections of insects, plants, reptiles, and other animals grew almost beyond manageable numbers. At every opportunity Charles crated his specimens and sent them back to London by other ships, but still the deck by his cabin was crowded with barrels and cartons. He began to find it difficult even to store his many notebooks.

Charles' jungle explorations were marked by excitement and daily hardships, for most of South America was raw and uncivilized. Much of the country was uncharted. Not only was Charles in constant danger of attack by wild animals, but the jungle teemed with disease-carrying insects and poisonous reptiles. Despite these dangers, Charles' zeal for discovery continued to grow as he began to think in a completely new way about the living things he was studying.



In Brazil, he found that the shapes and colors of insects and animals helped to hide them from their enemies. Many insects looked like twigs, leaves, bark, or flower petals; some animals were patterned to match jungle foliage, others imitated dead leaves or even shadows. Charles began to consider the idea that every physical trait of every living thing—color, form, size, tooth, tail, and claw—might serve just one purpose, to help it survive!

In Argentina, farther to the south, Charles located more evidence of this struggle to survive. There, two kinds of huge plants—the giant thistle and the cardoon—had conquered hundreds of square miles of grassland. These plants, brought from Europe by early settlers, had spread so widely that the country was impassable to man. Here was a dramatic example of natural conquest. The plants best suited to the environment had survived, while those poorly adapted had decreased in number and finally vanished.

In another part of Argentina, Patagonia, Charles uncovered an extraordinary skeleton. The animal appeared to have the body of a rhinoceros and the neck of a llama. Charles asked himself whether this animal had been created by God when the earth began. If this strange creature resulted from a special act of creation,



why did it resemble two living animals so closely? Knowing Captain Fitzroy's rigid beliefs on the subjects of God and Creation, Charles took care not to express any opinion about the significance of his discovery.

One year after the H.M.S. *Beagle* left England, she dropped anchor off the coast of Tierra del Fuego, at the southern tip of South America.

For Captain Fitzroy, landing at Tierra del Fuego meant that he would see the end of an experiment begun on a previous voyage to that remote land in 1828. He had taken to England four natives: three men—Jemmy Button, Boat Memory, and York Minster—and a young girl, Fuegia Basket.

Soon after their landing in England, Boat Memory died of smallpox. The three surviving natives were taught English and sent to school at Captain Fitzroy's expense. He planned to return them to Tierra del Fuego, hoping to introduce English customs to that part of the world.

For Charles the prospect of exploring Tierra del Fuego held two promises. First, he had been told that there he would encounter the most primitive people on earth. Secondly, the geology of the country excited his imagination. Here the great Andes Mountains emerged from the sea to form the backbone of South America.

The weather at Tierra del Fuego was usually wet and freezing. The ominous jagged mountains were often hidden by fog. The valleys were torn by deep glaciers that reached to the edge of the sea; enormous



icebergs filled the bays and inland passages. The place names reflected the bitterness other explorers had felt toward Tierra del Fuego: Desolation Island, Cape Deceit, Useless Bay, Port Famine.

Charles wondered what people could live in such a land. During his first exploration ashore he was repelled by the miserable life he saw. Most of the natives were naked. Their skins were greasy and covered with grime; their faces were daubed with white paint. The Fuegians' houses were tent-shaped piles of wood. Many of them had no shelter at all and slept curled up like animals on the wet ground. For food, they fished with snares or gathered shellfish at low tide. The discovery of a dead seal or whale on the beach meant a feast for the whole village. Charles asked himself whether men in his own country had ever lived in such conditions.

The Fuegians who returned on the *Beagle* had indeed been changed by their stay in England. They





wore English clothes; they were polite and had learned enough English to be understood.

But Captain Fitzroy's plan to civilize Tierra del Fuego failed. The months that followed the Fuegians' return to their village did not go well. York Minster and Fuegia Basket disappeared. The missionary returned to the ship in fear for his life, and the equipment brought to civilize the Fuegians was stolen or destroyed. Only Jemmy Button remained. It was he who waved farewell to the men of the *Beagle* as the ship moved toward the open sea.

By June of 1834, the *Beagle* had proceeded through the Strait of Magellan to the Pacific and struck a course north up the coast of Chile.

The following months were to be full of discovery and adventure. Charles was to explore the primeval forests of Valdivia on the lower slopes of the Andes Mountains; he was to travel five hundred miles over the lifeless coastal desert of Atacama; he would even climb and finally cross and recross the great Andes.

In January, 1835, the *Beagle* anchored in San Carlos Bay in the Chiloé Islands. One night Charles was awakened by a dull roar, followed by cries from the deck watch. He rushed from his cabin. To the east there was a fiery light that looked like a giant star.



Through his telescope, Charles saw an erupting volcano. Great tongues of fire shot skyward along with rock and white-hot ashes. The crew rushed on deck; many of the men climbed the ratlines for a better view. By 3 A.M. the explosions were bright enough to light up the masts and rigging. By dawn the spectacle had ceased and the earth was quiet.

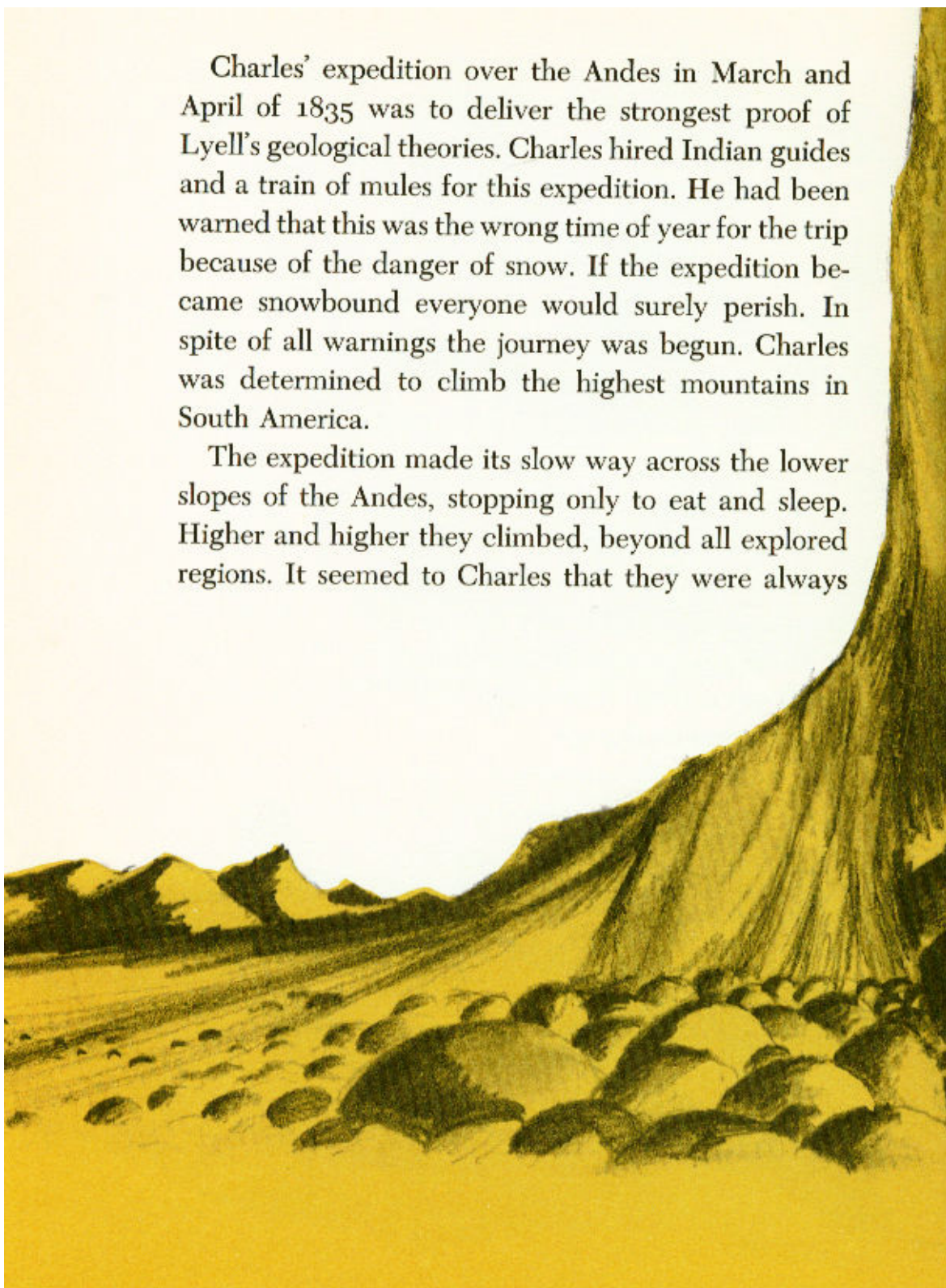
The following month Charles witnessed another kind of frightening earth change. On a clear, windless day, he went ashore and took a long walk through the forest edge at Valdivia. He became tired and decided to rest. He stretched out on the ground. Suddenly there was a thunderous boom! The ground beneath him rose and fell like the deck of his ship; the trees waved and shuddered as thousands of birds took flight in alarm. In two minutes the motion had stopped and all became quiet again. Later Charles learned that he had been on the edge of an earthquake area. His experience had been mild compared with that of people two hundred miles north. Following the quake there, a great tidal wave had crashed over the shore, hurling ships and small craft onto the beaches.

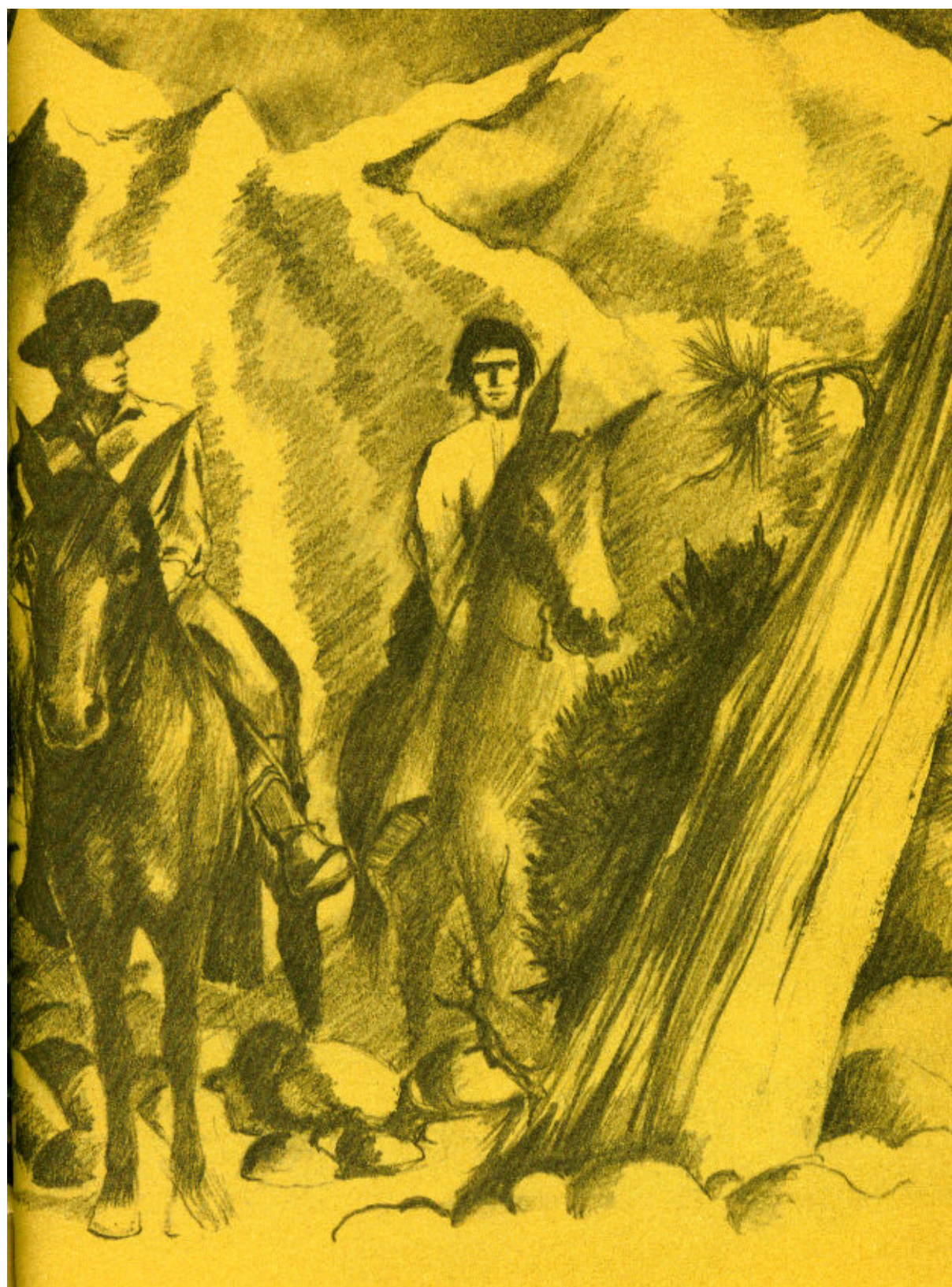
These great earth upheavals convinced Charles that Lyell was correct. Perhaps, in fact, the earth was in a state of constant change.

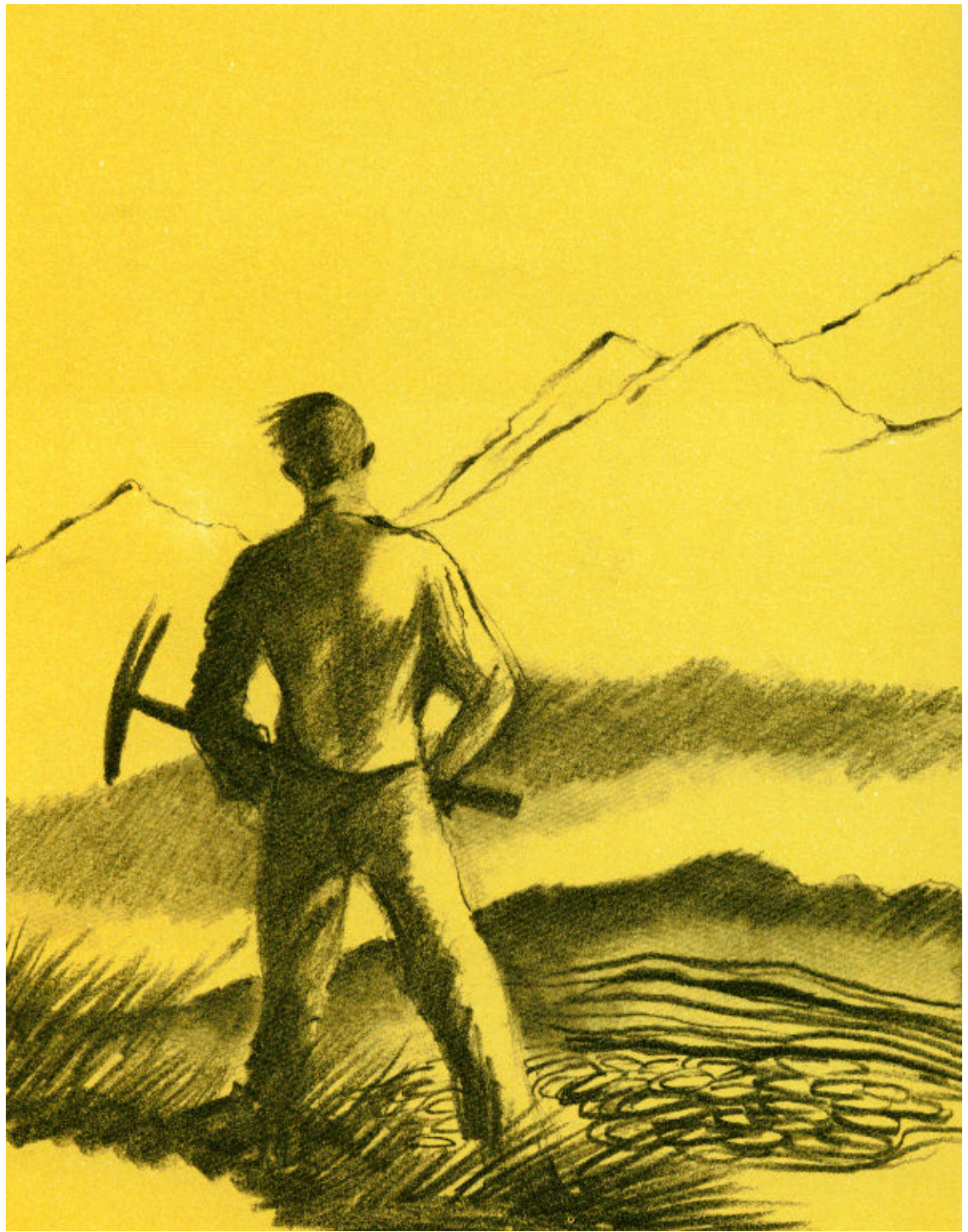


Charles' expedition over the Andes in March and April of 1835 was to deliver the strongest proof of Lyell's geological theories. Charles hired Indian guides and a train of mules for this expedition. He had been warned that this was the wrong time of year for the trip because of the danger of snow. If the expedition became snowbound everyone would surely perish. In spite of all warnings the journey was begun. Charles was determined to climb the highest mountains in South America.

The expedition made its slow way across the lower slopes of the Andes, stopping only to eat and sleep. Higher and higher they climbed, beyond all explored regions. It seemed to Charles that they were always







watched from a distance by shy observers—the guanacos. As they climbed higher, even these graceful deerlike creatures disappeared. Sometimes condors flew overhead—the largest birds on earth, with wingspreads as much as sixteen feet.

When they reached a height of two miles, the thin air made breathing difficult. Even the mules would halt every fifty yards and pant for air. There was danger from falling rocks and the skies looked heavy with snow. The Indian guides prayed daily that no snow would fall.

At thirteen thousand feet above sea level, Charles made a fantastic discovery. He found shells of animals that had once lived beneath the Pacific Ocean. "What luck!" he thought. "What incredible luck!" The shells that he carefully packed in his saddlebags showed that the great Andes were not formed in a day, but had risen from the sea over millions of years.

Luck was with the expedition all the way; the crest of the Andes was reached without mishap and the snow warnings proved false. In April the expedition returned safely to the coast. The first thing Charles did was to write Charles Lyell telling him of the half-a-mule-load of proof that he would be bringing home to England.

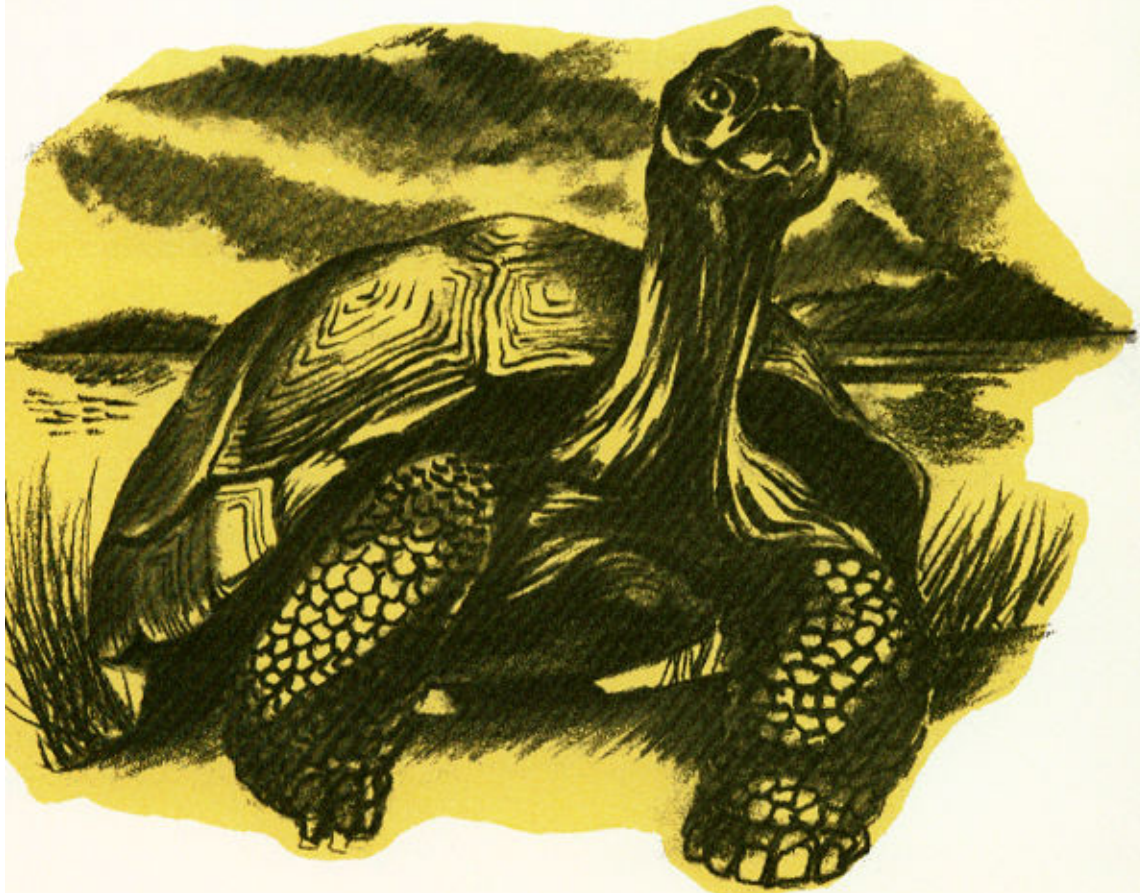
It was now more than three years since Charles had left England. He was no longer a gifted amateur naturalist, but a mature scientist. Now that he felt he had proven the Lyell theory of the earth's development, he turned his mind to the question of life on earth. Might it be possible that animal and plant life had also evolved over millions and millions of years? Charles remembered the skeleton he had found in Argentina that seemed to be part rhinoceros and part llama. He considered how each animal of the same species was always slightly different from another. He also considered how each creature seemed to be perfectly suited to the place where it lived. He had found the answers to the Lyell theory. Where would he find the answer to this new question?

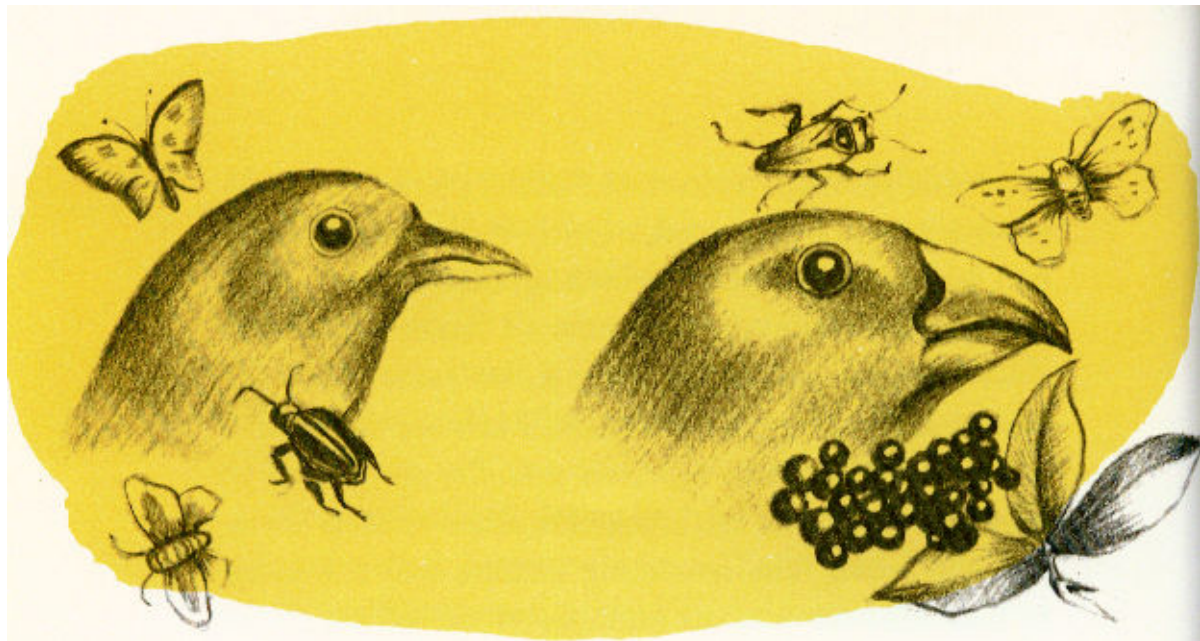
On the morning of September 17, 1835, the *Beagle* dropped anchor in the Galapagos Islands. These islands were first discovered by the Spaniards, who called them the Enchanted Isles. For three hundred years they had been uninhabited except for pirates and whaling crews.

It was hot and humid the morning Charles stepped ashore on Chatham, the first of the Galapagos which he was to explore. The beaches and slopes of the island were covered with slag and black lava thrown from

hundreds of small volcanoes. Little plant life could survive except brushwood, cactus, and weeds. Charles had never seen a place less inviting than this.

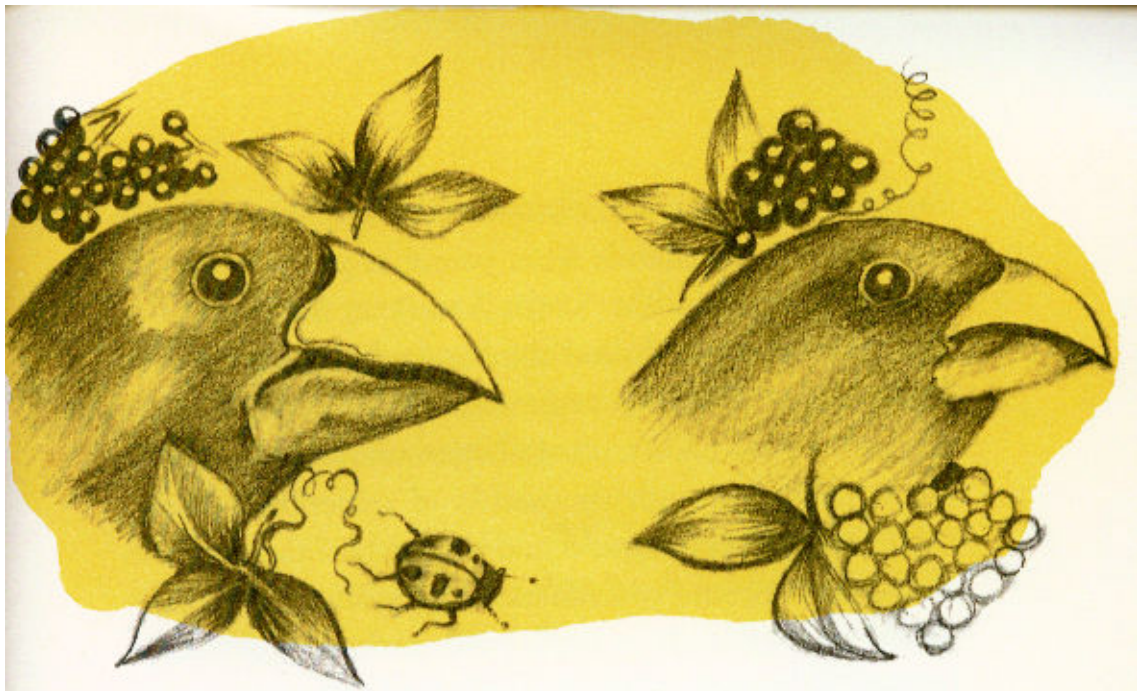
Beyond a clump of huge cactus Charles discovered a well-beaten path. Following it, he came upon the path-makers: two giant tortoises. Each one must have weighed at least two hundred pounds; one hissed at him and withdrew its head, the other walked away into the brush. The remaining tortoise was a wonder to behold; here was an example of the oldest living creature on earth. It was three, perhaps even four hundred years old.





The giant tortoises were not the only reptiles unique to the islands. Charles soon observed another kind of reptile that had survived from some remote age of the earth—black, scaly sea lizards. Creatures like these had not been found anywhere else in the world. Hundreds of them sunned themselves on the lava cliffs of the shore lines. They were excellent swimmers and were sometimes observed hundreds of yards offshore. The largest weighed twenty pounds and were about three feet long. In spite of their fierce appearance they were harmless.

In the following weeks, Charles traveled from island to island. In the Galapagos, each island seemed to have its own variety of birds and animals. One of Charles'



most important scientific theories came about because of his study of thirteen kinds of finches that were found on the different islands. These birds later became known as "Darwin's finches," for they gave Charles the clues to some amazing and original ideas about all life.

The finches could be divided into four groups: those that ate insects only; those that ate insects and some plants; those that ate plants and some insects; and those that ate only plants. Charles noted that each group had beaks perfectly adapted for the kind of food it preferred; furthermore, each group had plumage colored to conceal the finch in the surroundings where it fed and nested.

Charles began to form a theory to explain how these

variations had come about: some time in the remote past when these islands were young, a parent-stock of finches came from the South American mainland. As their numbers multiplied they spread through the islands. Some offspring began to inhabit ground areas where they ate plants, others began to live in trees and ate berries. Through thousands of generations their food habits became more and more specialized; their beaks also became specialized to help them get a particular kind of food—to crack hard seeds, to pluck large berries, or to pierce insects. And their plumage gradually became colored to match the backgrounds where they lived.

As Charles checked and rechecked his notes he realized how far-reaching these ideas might be. If the finches had undergone such changes it was probable that all living creatures had evolved in a similar way. If he was correct, the implications of his theory were fantastic to imagine. He had an explanation of the mystery of mysteries—the first appearance of new beings in the world. Charles realized that complete proof would require years of patient work, but he had already taken the first step toward his theory of the origin of species.

At dusk on October 2, 1836, the H.M.S. *Beagle*

dropped anchor in Falmouth Harbor. Charles had finally come home.

True to the promise he had made himself, Charles married Emma in the church at Maer on January 29, 1839. He devoted the years that followed to his family and to research and writing.

In 1859, Charles published his great scientific work, *The Origin of Species*. In this book he presented his theory of evolution. This theory holds that all living things, even the most complex, have evolved from simpler forms of life. Charles reasoned that since many, many more creatures are born than can ever grow up and reproduce, there is a constant struggle for survival. Only the best adapted will survive and pass their traits on to another generation. Charles described this process as evolution through natural selection.

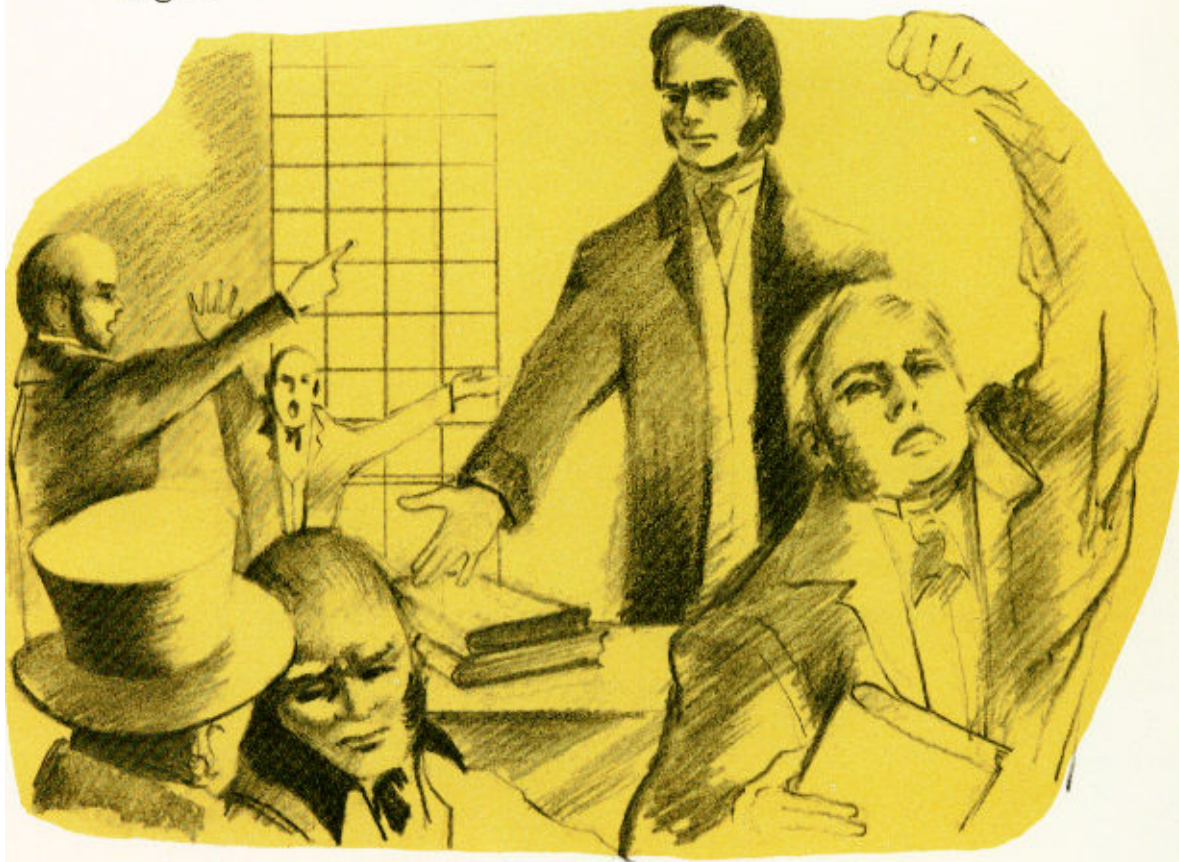


The book was published on November 24th. Every copy was sold the first day. Within a week there were public speeches condemning Charles. Men of religion, science, and government and the general public hurled charges: How, they asked, could any sane person conceive of the idea that God had not made a perfect, finished, unchanging world in six days? The animals of the earth today, they said, were no different from those that had emerged two by two from Noah's ark. Clearly, in the minds of most people, Charles Darwin was a heretic who not only denied the truth of the Bible, but implied that apes were the relatives of men. The uproar continued to grow.

The full fury of the attack on Charles came on June 30, 1860, at Oxford University at the meeting of the British Association for the Advancement of Science. More than seven hundred men and women attended. Charles Lyell was there, yet even he did not give the Darwin theory his full support. Arguments for and against the theory raged. Most people argued against Charles.

Unexpectedly, it was the great biologist Thomas Huxley who came to his defense by stating that in his opinion Charles Darwin's theory of evolution was scientifically correct. Huxley was then attacked by the

Bishop of Oxford, Samuel Wilberforce, who asked him, sarcastically, if he were descended from an ape through his grandfather or his grandmother. Huxley replied that he would rather have an ape for an ancestor than the Bishop. With this the meeting broke into total disorder. There was shouting and screaming. A woman fainted and was taken from the hall. In the midst of the uproar the uniformed figure of Robert Fitzroy stood waving the Bible. He shouted to the crowd: "This is the only authority, not that viper Darwin!" A great battle between religion and science had begun.



In 1871 Charles published a second great work, *The Descent of Man*, in which he applied the theory of evolution to human beings. The old voices of protest rose again, but with less vigor than before. Times had changed, and in the decade that had passed since his theory was made public much of the scientific world had accepted the truth of his findings.

By this time, Charles had grown older and less active. With the publication of *The Descent of Man*, he felt that his major work in science was done. He was now sixty-two years old; his beard had turned white and his walk was slow. Poor health and fatigue made new research doubly hard, yet he continued with his usual determination to test his theories.

By 1875 Darwin was world-famous. He had received honors and prizes from universities and governments everywhere. The highest moment of his career came on November 17, 1877, in the Senate House of his own University of Cambridge, before hundreds of men of science and government. Charles and Emma heard the solemn words of the Vice-Chancellor: "You, who have so learnedly illustrated the laws of nature, are declared our Doctor of Laws." This was one of the greatest honors in the name of science that his countrymen could give.